CHAPTER 4 - EMISSIONS CONTROL ANALYSIS: DESIGN AND ANALYTIC RESULTS

This chapter documents the illustrative emission control strategy we applied to simulate attainment with the revised NAAQS and alternative standard. Section 4.1 describes the approach we followed to select cost-effective emissions controls to simulate attainment in each projected nonattainment area. Section 4.2 summarizes the emission reductions we simulated in each projected nonattainment area based on current knowledge of emissions controls applicable to existing sources of lead emissions, while Section 4.3 presents the air quality impacts of these emissions reductions.. Section 4.4 discusses the application of additional "unidentified" controls, beyond those already known to be available, that we estimate will be necessary to reach attainment in certain monitor areas. Section 4.5 discusses key limitations in the approach we used to estimate the optimal control strategies for each standard.

4.1. Estimation of Optimal Emissions Control Strategies

Our analysis of the emissions control measures required to meet the proposed NAAQS and alternative standard is limited to controls for point source emissions at active sources inventoried in the 2002 NEI. [Note that while airports are included as point sources in the NEI, our analysis considers the impact of emissions from use of leaded aviation gasoline (avgas) at airports, but does not consider controls on those emissions as a strategy for NAAQS compliance. EPA received a petitioned from Friends of the Earth requesting that the Agency find that aircraft lead emissions may reasonably be anticipated to endanger the public health or welfare, and to take action to control lead emissions from piston-engine aircraft. We published a Federal Register notice discussing the petition and requested comment on specific aspects of the use of leaded avgas and potential control of lead emissions from the consumption of avgas.[1]] Finally, as discussed in Chapter 3, a portion of ambient lead concentrations can also be attributed not to point sources but to miscellaneous re-entrained dust and area nonpoint emissions. Nevertheless, this RIA deals only with the application of controls on emissions at active non-aviation point sources, including stack emissions and fugitive emissions from industrial processes.

[1] The petition requested that EPA find that such emissions cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare. And, if EPA makes such a finding, the petitioner requested that EPA take steps to reduce lead emissions under the authority of the Clean Air Act Section 231 Approximately 70 different parties commented on the petition and the questions presented in the notice (72 FR 64570, November 16, 2007). These comments can be found in EPA public docket OAR-2007-0294 (at www.regulations.gov). A clear theme in many of the comments was the dependence of much of the current piston-powered aircraft fleet on leaded avgas either because of engine design, performance demands, or lack of mogas availability at airports. However, several comments identified potential near and longer term measures to reduce these lead emissions. These potential measures fall into five general categories: (1) Continued work on identifying fuel blends or additives which would provide the octane and other performance characteristics needed for a transparent fuel replacement, (2) Measures to ensure greater availability of ethanol-free unleaded avgas at airports for those aircraft which otherwise could use it, (3) Laboratory and field work to assess the potential to reduce the amount of lead now added to current leaded avgas, (4) Add-on engine technology or fuel management technology to allow for equivalent engine performance at lower avgas octane ratings and (5) Long-term measures or standards for new engines which provide the needed and desired performance characteristics using modified engine designs and calibrations on fuels or fuel blends not containing lead. For more information about the petition, see http://www.epa.gov/otaq/aviation.htm.

To simulate attainment of the four regulatory alternatives considered in all 36 monitor areas, we first modeled the most cost-effective application of identified emissions controls in each area, using the following three step process:

1. Specification of baseline emissions for inventoried point sources in each nonattainment area

2. Identification of potential controls for inventoried point sources

3. Identification of the least cost strategy for using point source controls.

In areas where identified emissions controls were not sufficient to reach attainment with one or more of the standards considered, we also simulated the application of unidentified emissions controls to inventoried point sources. Further discussion of the application of unidentified controls is presented in Section 4.4.

<u>Step 1: Specification of Baseline Lead Emissions for Inventoried Point Sources</u>. For most sources, lead emissions as specified in the 2002 National Emissions Inventory (NEI) served as the baseline for our analysis. As discussed in Chapter 2, we did not apply growth factors to the 2002 NEI emissions estimates to predict emissions in 2020 (the analysis year for this RIA) because we believe that the number of Pb emitting sources will not increase with population growth as assumed in Chapter 5. We did, however, adjust the 2002 NEI lead emissions values to reflect anticipated emissions controls necessary to comply with other regulations that have compliance deadlines after 2002, wherever possible. These adjustments included application of MACT for air toxics rules with post 2002 compliance deadlines[2], PM controls at sources in designated nonattainment areas in the 2006 revisions to the $PM_{2.5}$ NAAQS as modeled in the illustrative control strategy in the $PM_{2.5}$ NAAQS RIA[3], and controls planned for the Doe Run Herculaneum lead smelter as part of the 2007 Missouri lead SIP (at the one current nonattainment area for ambient lead under the Federal CAA).[4] After applying these adjustments to all affected point sources, the remaining lead emissions served as our baseline for the application of identified controls. Table 4-1 illustrates the process used to specify the baseline lead emissions for inventoried point sources in the analysis.

Table 4-1. Total Baseline Lead Emissions for all Inventoried Point Sources in 36 Designated Monitor Areas

Original Baseline: 2002 NEI Emissions (point sources, excluding airports)	159.0 tons/year (tpy)
2002 NEI Emissions with PM NAAQS controls	157.8 tpy

[2] The MACT standards included covered the following industries: Integrated Iron and Steel Manufacturing, Iron and Steel Foundries, Petroleum Refineries, Secondary Aluminum Production, Industrial/Commercial/Institutional Boilers & Heaters – Coal, Lime Manufacturing, Pressed and Blown Glass and Glassware Manufacturing, Primary Nonferrous Metals – Zinc, Cadmium, and Beryllium, Secondary Nonferrous Metals, Primary Copper Smelting, Secondary Copper Smelting.

[3] Available at http://www.epa.gov/ttn/ecas/ria.html

[4] This lead SIP was finalized by EPA on April 14, 2006 with a requirement that this SIP will provide attainment with the current lead standard by April 7, 2008. The SIP is available at http://www.dnr.mo.gov/env/apcp/docs/2007revision.pdf

2002 NEI Emissions with PM NAAQS and Herculaneum SIP controls	146.9 tpy
Final Baseline: 2002 NEI Emissions with MACT, PM NAAQS, and Herculaneum SIP controls	132.5 tpy

Following the same process as described above, we also specified baseline PM_{10} and $PM_{2.5}$ emissions for all inventoried point sources. Although the non-lead fraction of PM emissions did not play a role in simulating attainment with the lead NAAQS and alternative standard, we did use these baseline values to estimate the ancillary benefits of co-controlling PM emissions in the process of implementing lead control strategies, as discussed in Chapter 5. Recent promulgation of mobile source rules that reduce PM is not relevant for this analysis.

Step 2: Identification of Potential Controls for Point Sources in each Nonattainment Area. To identify point source lead emissions controls for our analysis, we collected information on PM control technologies, assuming that the control efficiency for PM would also apply to lead emissions. We collected this information in the following way:

1. We queried EPA's AirControlNET database for information on potential PM controls available for each source, accounting for any control measures already in place, according to the 2002 NEI.[5]
2. For sources with Standard Industrial Classifications (SICs) but without identified NEI Source Classification Codes (SCCs), we used the SIC/SCC crosswalk in Appendix C of AirControlNET's Documentation Report to identify SCCs for those sources.[6] We then found controls in AirControlNET's database associated with these SCCs.
3. EPA identified additional controls from New Source Performance Standards and operating permits that apply to facilities with similar SCC codes as the point sources in our analysis.

Completion of the procedure outlined above yielded identified controls for about 28 percent of the total inventoried point sources in our analysis. However, because of the skewed distribution of lead emissions in the 2002 NEI (the top 10 percent of inventoried point sources account for over 98 percent of total lead emissions), these sources accounted for more than 75 percent of total lead emissions, as shown in Table 4-2.

Table 4-2 Profile of Inventoried Point Sources, With and Without Identified Controls

	Count	Percent of Total	Emissions (tons/year)	Percent of Total
Sources with Identified Controls	642	28.2%	100.4	75.8%
Sources without Identified Controls	1,634	71.8%	32.1	24.2%
Total	**2,276**	**100.0%**	**132.5**	**100.0%**

[5] Documentation Available at http://www.epa.gov/ttnecas1/models/DocumentationReport.pdf. AirControlNET's database of PM controls normally excludes sources emitting fewer than 10 tons/year of PM_{10}. Because many of the point sources included in our analysis fall below this threshold and because this analysis focuses entirely on obtaining emission reductions from point sources, we effectively reduced the threshold from 10 tons/year to zero in order to identify controls for a larger number of inventoried point sources.

[6] Available at http://www.epa.gov/ttnecas1/models/DocumentationReport.pdf.

Controls identified through this process include major emissions controls, such as fabric filters, impingement-plate scrubbers, and electrostatic precipitators; and minor controls, such as increased monitoring frequency, upgrades to continuous emissions monitors, and diesel particulate filters. For each identified control, we identified both the expected control efficiency for the technology and the annualized cost of installing and operating the control.[7] For those point sources where the 2002 NEI indicated that control measures were already in place, we estimated the effective emissions control efficiency for each identified control by estimating the emissions reductions that would result if the pre-existing control were replaced by the identified control technology. Thus, while a fabric filter might have an expected control efficiency of 90 percent when installed in the absence of pre-existing controls, for example, if it were applied at a source that already had an electrostatic precipitator with an 80 percent control efficiency, the *effective* control efficiency of the Fabric Filter would be 50 percent.[8] We also assumed that each identified control technology would be installed in addition to any controls required under the 2006 $PM_{2.5}$ NAAQS and any MACT rules with enforcement dates after 2002, but before 2020. We therefore applied each control's effective control efficiency to the adjusted baseline lead emissions at each inventoried point source.[9]

Step 3: Identification of the Optimal Strategy for Using Point Source Controls to Reach Attainment in Each Area. To identify the least-cost approach for reaching attainment in each area, EPA developed a linear programming optimization model that systematically evaluates the air quality and cost information discussed below and in Chapter 6 to find the optimal control strategy for each area. The optimization model first identifies the measures that each source would implement if it were controlled as part of a local lead attainment strategy. Based on these controls, the optimization model then identifies sources to control such that each area would reach attainment at the least aggregate cost possible for the area. Minimizing total costs is not always equivalent to minimizing marginal costs, as described in greater detail below. Therefore, although the model selects major controls for each source by minimizing the marginal cost/ton of lead controlled at the source, the objective at the nonattainment area level is to minimize total costs to reach attainment.

Rather than considering all emissions controls at every inventoried point source, the optimization model utilizes a three-stage filtering process to select only the most cost-effective controls at sources making a significant impact on ambient air quality. The stages are as follows:

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[7] See Chapter 6 for a detailed discussion of how annualized control costs were estimated.

[8] With the electrostatic precipitator, 20 percent of the source's original, uncontrolled emissions would remain uncontrolled, but with the fabric filter, only 10 percent of the source's original emissions would remain uncontrolled. Thus, replacing the electrostatic precipitator with the fabric filter would represent a 50 percent (10/20 = 0.5) decrease in uncontrolled emissions. For the purpose of estimating costs, EPA counted the full replacement cost.

[9] The one exception to this assumption is the installation of capture hoods vented to baghouses, a control included at some sites as part of the control strategies applied for the 2006 $PM_{2.5}$ revised NAAQS RIA. Because baghouses are major controls which would be replaced by the installation of any other major control, we applied the effective control efficiency of major controls to the *unadjusted* baseline emissions at any site with a capture hood installed. For the purpose of estimating costs, EPA counted the full replacement cost.

1. First, the model selects all controls at sources deemed "relevant" by virtue of the fact that they account for at least 0.001 percent of all point source contributions to the ambient lead concentration in their monitor area. This stage mostly affects monitor areas with large numbers of inventoried point sources, such as Los Angeles, where 156 out of 266 inventoried sources do not meet the 0.001 percent threshold.

2. Because we identified multiple major emissions controls for many sources, the second stage of the model assumes that the most cost-effective major control for each relevant source would be installed, as determined by cost/ton of lead emissions reduced. For example, consider a source that could install either an electrostatic precipitator (ESP) that would reduce lead emissions by 0.1 tons/year with an annualized cost of $1 million or a fabric filter that would reduce lead emissions by 0.11 tons/year at a cost of $2 million/year. Because the cost/ton is lower for the ESP, the optimization model assumes that the source would (potentially) install the ESP rather than the fabric filter.[10] Unlike major controls, all minor controls identified can be implemented in conjunction with other controls, so the model selects all minor controls as well.

3. In the third and final stage, we remove from consideration all controls with a cost/ton higher than the 98th percentile of control costs at large emission sources, through a process described in Section 4.4.2 below.

After selecting the most cost-effective emissions controls at all relevant point sources for each monitor area, the model then proceeds to evaluate every possible combination of control technologies until the monitor area reaches attainment with the selected NAAQS or alternative standard at the lowest possible cost. If the monitor area is already in attainment with the selected standard, the model applies no controls. On the other hand, if the monitor area is unable to reach attainment with the selected standard when all cost-effective controls at relevant sources are applied, then the model is re-run without a lower threshold on source contribution to ambient Pb concentration (i.e. the model eliminates the stage 1 filter described above).

As indicated above, this approach is not the equivalent of moving up the marginal abatement cost curve for lead. If the control strategy were selected based on the marginal cost/$\mu g/m^3$ reduced, we would not necessarily identify the least-cost strategy for attainment in each area. For example, consider an area that needs to reduce its ambient lead concentration by 0.001 $\mu g/m^3$ to reach the standard. If the area could reduce its lead concentration by 0.0011 $\mu g/m^3$ at a cost of $1 million by controlling Source A or reduce the lead concentration by 0.007 $\mu g/m^3$ at a cost of $5 million by controlling Source B, the

[10] If there are two available control options, the least-cost approach chooses the option with a lower cost/ton. It does this even if a slightly more expensive control option can achieve greater emission reduction. It is unlikely that a large amount of potential emission reduction is missed by this approximation, because the control efficiencies of major controls do not differ significantly.

optimization model would choose Source A, even though it has a higher cost/μg/m^3 controlled. Controlling Source B would minimize the marginal cost/μg/m^3; controlling Source A would minimize total costs.

4.2. **Lead Emissions Reductions Achieved with each Control Strategy**

Utilizing the optimization model described above, we determined the most cost-effective control strategies required to meet attainment at the largest number of monitor areas.[11] Table 4-3 presents the lead emissions reductions realized at each monitor area under the control strategies followed for each standard.

[11] As will be discussed below, the application of identified controls was insufficient to bring all monitor areas into compliance with the proposed NAAQS and the alternative standard.

Table 4-3. Reduction in Lead Emissions under Alternative NAAQS at each Monitor Area, Identified Controls Only.

Monitor State	Monitor County	Baseline Lead Emissions in 2020	Reduction in Lead Emissions (tpy) under Proposed NAAQS and Alternative Standard			
			Proposed NAAQS: 0.30 μg/m³ 2nd Maximum Monthly Mean	**Proposed NAAQS: 0.20 μg/m³ 2nd Maximum Monthly Mean**	**Proposed NAAQS: 0.10 μg/m³ 2nd Maximum Monthly Mean**	**Alternative Standard: 0.05 μg/m³ 2nd Maximum Monthly Mean**
AL	Pike	4.45	4.03	4.13	4.40	4.40
CA	Los Angeles	0.72	0.00	0.00	0.00	0.00*
CA	San Bernardino	0.12	0.00	0.00	0.00	0.00*
CO	Adams	2.44	0.04*	0.04*	0.04*	0.04*
CO	Denver	2.77	0.04	0.08*	0.08*	0.08*
CO	El Paso	0.95	0.00	0.00	0.00*	0.00*
FL	Hillsborough	1.73	1.10	1.19	1.26	1.26
GA	DeKalb	0.03	0.00	0.00	0.00	0.00*
GA	Muscogee	0.47	0.00	0.00	0.00	0.23*
IL	Cook	0.90	0.00	0.00	0.00	0.49*
IL	Madison	0.53	0.00	0.00	0.10*	0.10*
IL	St. Clair	1.71	0.00	0.00	0.10	0.41*
IN	Delaware	1.53	1.37*	1.37*	1.37*	1.37*
IN	Lake	7.26	0.00	0.00	0.00	1.51
IN	Marion	5.65	0.00	0.00	0.00	1.49
MN	Dakota	4.51	0.00	0.00	3.07	3.07
MO	Iron	27.84	12.20	12.28*	12.28*	12.28*
MO	Jefferson	47.89	9.69*	9.69*	9.69*	9.69*
MO	St. Louis	0.02	0.00	0.00	0.00	0.00
NJ	Middlesex	1.72	0.00	0.00	0.00*	0.00*
NY	Orange	1.80	0.00	1.40	1.40	1.49*
OH	Cuyahoga	1.20	0.22	0.32*	0.32*	0.32*
OH	Fulton	0.49	0.11*	0.11*	0.11*	0.11*
OH	Logan	0.12	0.00*	0.00*	0.00*	0.00*
OK	Ottawa	0.00	0.00	0.00	0.00*	0.00*
PA	Allegheny	0.22	0.00	0.00	0.00	0.14
PA	Beaver	5.02	0.00	0.55	0.88*	0.88*
PA	Berks	2.18	1.57*	1.57*	1.57*	1.57*
PA	Cambria	0.01	0.00	0.00	0.00	0.00*
PA	Carbon	0.46	0.00	0.00*	0.00*	0.00*
TN	Sullivan	0.38	0.00	0.00	0.00*	0.00*
TN	Williamson	2.55	1.97	2.07	2.31	2.53
TX	Collin	3.18	2.24	2.70	2.95	3.14
TX	Dallas	0.03	0.00	0.00	0.00	0.00*
TX	El Paso	0.18	0.00	0.00	0.00	0.00*
UT	Salt Lake	4.41	0.00	0.00	0.74	3.56
Total**		132.5	34.6	37.5	42.7	50.2

* Indicates monitor area does not reach attainment using identified controls.

** Total values do not equal the sum of emissions and reductions values for each monitor area, as some sources are within 10 kilometers of two monitors, and therefore the single emissions reduction is counted in each relevant monitor area. Note also that total lead emissions values do not represent nationwide totals, but rather the total baseline emissions at the 36 potential nonattainment areas considered in this analysis.

4.3. **Impacts Using Identified Controls**

Following the steps described in Section 2.1.2, we estimated the overall change in ambient air quality achieved as a result of each of the control strategies identified in the AirControlNET based emissions analysis. Table 4-4 presents a detailed breakdown of the estimated ambient lead concentrations in 2020 at each of the 36 monitor sites under the four alternative standards described in Chapter 1.

- According to the data presented in Table 4-4, 20 of the 36 monitor areas are expected to reach attainment with any target NAAQS in the proposed range of 0.10 to 0.30 ug/m^3 following implementation of the controls identified in the AirControlNET analysis (i.e., identified controls). For some areas, however, identified controls are not sufficient to reach attainment with one or more of the target alternatives in the proposed range. For the alternative of 0.05 ug/m3, only 10 of the 36 monitors are able to reach attainment from application of identified controls.

- The failure of certain areas to reach attainment with identified controls partially reflects the lack of control information for point sources in these areas. As indicated in Table 4-5, sources for which the AirControlNET analysis identified no controls make up a significant portion of the ambient lead concentration in many of the areas not projected to reach attainment with the proposed standard. For such sources in nonattainment areas, we assume that unidentified controls will be applied, as discussed further below.

- Table 4-5 also shows that in the case of the 0.05 ug/m3 target NAAQS, some areas fail to reach attainment in our analysis because the fraction of the ambient concentration associated with area nonpoint sources and miscellaneous re entrained dust exceeds the standard itself. Therefore, even if point source emissions were reduced to zero in these areas, they would not reach attainment.

- The projected nonattainment for some areas reflects the combined effect of the two factors described above.

Table 4-4. Ambient Lead Concentrations Achieved with Identified Controls Under the Alternative NAAQS in 2020.

Monitor State	Monitor County	Ambient Lead Concentration ($\mu g/m^3$) attained under Proposed NAAQS and Alternative Standards				
		Baseline Lead Concentration in 2020	**0.30 $\mu g/m^3$ Second Maximum Monthly Mean**	**0.20 $\mu g/m^3$ Second Maximum Monthly Mean**	**0.10 $\mu g/m^3$ Second Maximum Monthly Mean**	**0.05 $\mu g/m^3$ Second Maximum Monthly Mean**
AL	Pike	2.420	0.250	0.196	0.051	0.050
CA	Los Angeles	0.076	0.076	0.076	0.076	0.075*
CA	San Bernardino	0.068	0.068	0.068	0.068	0.068*
CO	Adams	0.440	0.434*	0.434*	0.434*	0.434*
CO	Denver	0.229	0.226	0.225*	0.225*	0.225*
CO	El Paso	0.131	0.131	0.131	0.131*	0.131*
FL	Hillsborough	1.380	0.214	0.123	0.048	0.048
GA	DeKalb	0.100	0.100	0.100	0.100	0.100*
GA	Muscogee	0.100	0.100	0.100	0.100	0.096*
IL	Cook	0.097	0.097	0.097	0.097	0.067*
IL	Madison	0.128	0.128	0.128	0.106*	0.106*
IL	St. Clair	0.093	0.093	0.093	0.093	0.070*
IN	Delaware	5.022	0.391*	0.391*	0.391*	0.391*
IN	Lake	0.053	0.053	0.053	0.053	0.049
IN	Marion	0.079	0.079	0.079	0.079	0.038
MN	Dakota	0.192	0.192	0.192	0.039	0.039
MO	Iron	1.454	0.232	0.224*	0.224*	0.224*
MO	Jefferson	0.527	0.425*	0.425*	0.425*	0.425*
MO	St. Louis	0.036	0.036	0.036	0.036	0.036
NJ	Middlesex	0.143	0.143	0.143	0.143*	0.143*
NY	Orange	0.240	0.240	0.084	0.084	0.074*
OH	Cuyahoga	0.377	0.279	0.260*	0.260*	0.260*
OH	Fulton	0.530	0.530*	0.530*	0.530*	0.530*
OH	Logan	0.360	0.360*	0.360*	0.360*	0.360*
OK	Ottawa	0.114	0.114	0.114	0.114*	0.114*
PA	Allegheny	0.064	0.064	0.064	0.064	0.047
PA	Beaver	0.224	0.224	0.200	0.191*	0.191*
PA	Berks	0.517	0.336*	0.336*	0.336*	0.336*
PA	Cambria	0.056	0.056	0.056	0.056	0.056*
PA	Carbon	0.294	0.294	0.294*	0.294*	0.294*
TN	Sullivan	0.154	0.154	0.154	0.154*	0.154*
TN	Williamson	0.820	0.206	0.174	0.100	0.031
TX	Collin	0.891	0.288	0.164	0.096	0.045
TX	Dallas	0.084	0.084	0.084	0.084	0.084*
TX	El Paso	0.054	0.054	0.054	0.054	0.054*
UT	Salt Lake	0.107	0.107	0.107	0.093	0.040

* Indicates that this monitor area did not reach attainment with the alternative standard.

Table 4-5. Baseline Lead Concentrations in μg/m^3 in Areas with Monitored Concentrations Greater than any of the Alternative NAAQS Using only Identified Controls.

Monitor State	Monitor County	Baseline Pb Concentration in 2020	Pb Concentration related to area non-point emissions and misc. re-entrained dust	Baseline Pb Concentration related to indirect fugitive and point source emissions		Total concentration associated with sources for which no control information available
				Point sources with no Identified Controls	**Point sources with Identified Controls**	
CA	Los Angeles	0.076	0.024	0.051	0.000	0.075
CA	San Bernardino	0.068	0.025	0.043	0.000	0.068
CO	Adams	0.440	0.024	0.342	0.073	0.366
CO	Denver	0.229	0.029	0.128	0.072	0.157
CO	El Paso	0.131	0.024	0.101	0.006	0.125
GA	DeKalb	0.100	0.057	0.043	0.000	0.100
GA	Muscogee	0.100	0.045	0.051	0.004	0.096
IL	Cook	0.097	0.024	0.033	0.040	0.057
IL	Madison	0.128	0.023	0.000	0.104	0.024
IL	St. Clair	0.093	0.023	0.039	0.032	0.061
IN	Delaware	5.022	0.050	0.001	4.970	0.051
MO	Iron	1.454	0.023	0.189	1.242	0.212
MO	Jefferson	0.527	0.023	0.000	0.504	0.023
NJ	Middlesex	0.143	0.024	0.118	0.000	0.143
NY	Orange	0.240	0.035	0.029	0.176	0.064
OH	Cuyahoga	0.377	0.025	0.219	0.133	0.244
OH	Fulton	0.530	0.025	0.505	0.000	0.530
OH	Logan	0.360	0.027	0.333	0.000	0.360
OK	Ottawa	0.114	0.023	0.091	0.000	0.114
PA	Beaver	0.224	0.026	0.000	0.199	0.026
PA	Berks	0.517	0.036	0.277	0.205	0.313
PA	Cambria	0.056	0.031	0.025	0.000	0.056
PA	Carbon	0.294	0.032	0.263	0.000	0.294
TN	Sullivan	0.154	0.023	0.131	0.000	0.154
TX	Dallas	0.084	0.029	0.054	0.001	0.083
TX	El Paso	0.054	0.028	0.024	0.002	0.052

4.4. Unidentified Controls

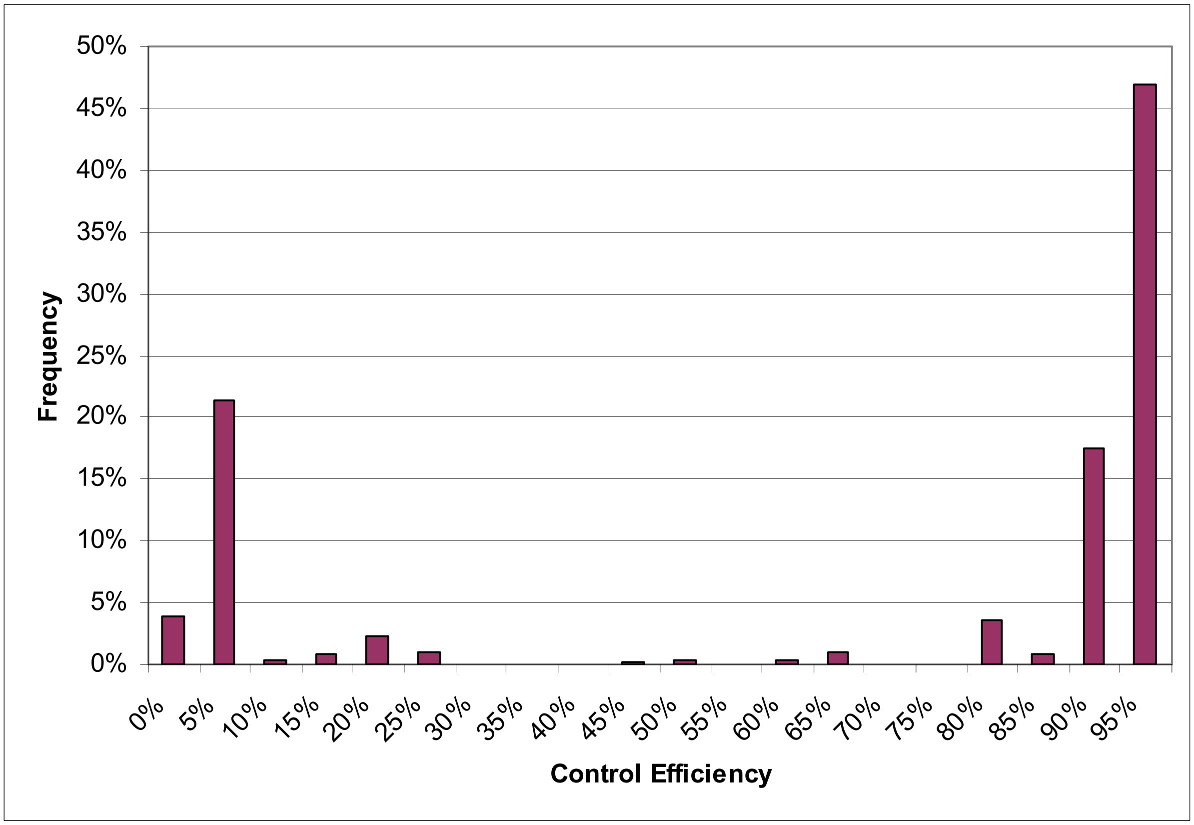
As discussed above, some monitor areas did not reach attainment with the proposed NAAQS or alternative standard through the application of identified controls alone in these illustrative control scenarios. In order to bring these monitor areas into attainment, we simulated the application of unidentified emissions controls on "large" emissions sources, defined as those sources emitting 0.05 tons/year or more in the 2002 NEI. Unidentified emission controls are hypothetical control technologies yet to be determined. We limited our consideration of unidentified controls to these sources in order to target facilities that will likely be the focus of efforts of local air quality managers to comply with the new NAAQS. Of the 2,230 point sources (excluding airports) in our analysis, 7.8 percent (174 sources) satisfy the 0.05 annual tpy (100 pound) or greater criteria, but they account for more than 97 percent of total adjusted baseline emissions.

In this section we discuss how we estimated the control efficiency of unidentified controls, how we applied these controls to point sources in our analysis, and the emissions reductions achieved with these controls. More in depth discussions of the air quality impacts of unidentified controls and the method of estimating the costs of these controls will be presented below and in Chapter 6.

4.4.1 *Estimating the Control Efficiency for Unidentified Controls*

We identified an appropriate central tendency measure of the efficiency of identified controls which could be applied to unidentified controls by examining the distribution of the control efficiencies of identified controls at large sources, as defined above. As Figure 4-1 indicates, the distribution of control efficiencies is bimodal, with a mean at 70.2 percent and a median at 95.0 percent. Based on this distribution, we chose 90 percent as a central tendency measure to be applied to the control efficiency of unidentified controls. We assumed that unidentified controls would be applied in addition to any identified emissions controls already installed at each source, meaning that the 90 percent control efficiency for unidentified controls would be applied to the emissions for each source. For the final RIA, we intend to revisit the choice of 90% as a representative control efficiency because of the underlying uncertainties associated with unidentified control technologies.

Figure 4-1. Histogram of Control Efficiency for Identified [PM?] Controls at Point Sources with 2002 NEI Emissions of 0.05 Tons/Year or Higher.

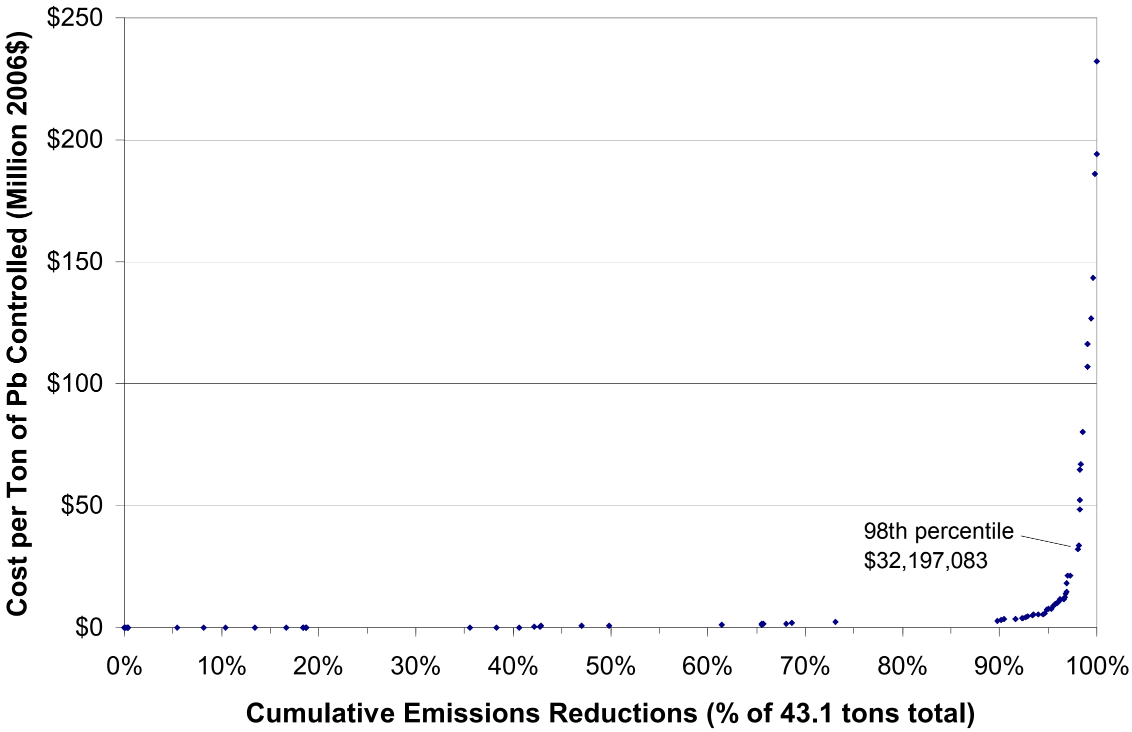


4.4.2. *Applying Unidentified Controls to Large Point Sources*

In the process of estimating the cost/ton of unidentified controls, we set a cost cap at the 98th percentile along the cumulative density function of the per ton costs of identified controls at "large" point sources, as shown in Figure 4-2. With the cost cap set at $32 million, we then determined that a nonattainment area would not implement any identified controls with per ton costs above this cost-effectiveness threshold.[12] This is a simplifying approach that will be refined in the final RIA. Removing all such controls from our database did not significantly impact emissions reductions or air quality impacts of the control strategies required for each standard.

[12] The use of the 98th percentile as a cost cutoff for identified controls is consistent with the method used in EPA's Final Ozone NAAQS Regulatory Impact Analysis, March 2008, available at http://www.epa.gov/ttnecas1/ria.html

Figure 4-2. Cumulative Density Function of Per Ton Costs of Identified Controls at Point Sources Emitting 0.05 Tons/Year or More (Millions of 2006$)



For each standard, we selected all monitor areas that failed to reach attainment and applied unidentified controls to large sources until attainment was reached. We applied an additional control efficiency of 90 percent to large sources closest to the monitor in an iterative fashion until the minimum lead emissions reductions required for attainment were reached.

4.4.3. *Lead Emissions Reductions Achieved with Unidentified Controls*

After applying unidentified controls using the process described above, all monitor areas but one reached attainment with the 0.3 $\mu g/m^3$ proposed standard and the 0.2 $\mu g/m^3$ proposed standard. For the 0.1 $\mu g/m^3$ proposed standard, six monitor areas did not reach attainment with the application of unidentified controls, either because control efficiencies greater than 90 percent were required at large sources or because small sources needed to be controlled in order to sufficiently reduce ambient lead concentrations. For the 0.05 $\mu g/m^3$ alternative standard, seventeen monitor areas could not reach attainment with any application of unidentified controls, for the reasons given above and because the fraction of the ambient concentration associated with area nonpoint sources and miscellaneous re entrained dust at some areas exceeds the standard itself, as mentioned in Section 4.3. Table 4-6 presents the lead emissions reductions required to bring the maximum number of monitor areas into attainment with each standard. Table 4-7 presents the lead emissions reductions realized for each monitor area using both identified and unidentified controls. Tables 4-8 and 4-9 present the air quality impacts of these emissions reductions and summarize the number of areas reaching attainment with the application of identified and unidentified controls.

Table 4-6. Total Lead Emissions Remaining and Lead Emissions Reductions Required with Unidentified Controls to Reach Attainment with the Alternative NAAQS.

Standard	Lead emissions Remaining after applying identified controls (Tons/Year)	Reduction in Lead Emissions with unidentified controls (Tons/Year)	Emissions remaining after applying identified and unidentified controls (Tons/Year)
0.3 µg/m^3 2nd Maximum Monthly Mean	98.0	12.2	85.5*
0.2 µg/m^3 2nd Maximum Monthly Mean	95.0	24.4	70.6*
0.1 µg/m^3 2nd Maximum Monthly Mean	90.0	48.2	41.8**
0.05 µg/m^3 2nd Maximum Monthly Mean	82.5	61.6	20.9***

* 35 out of 36 monitor areas reached attainment with this standard using identified and unidentified point source emissions controls.
** 30 out of 36 monitor areas reached attainment with this standard using identified and unidentified point source emissions controls.
*** 19 out of 36 monitor areas reached attainment with this standard using identified and unidentified point source emissions controls

Table 4-7. Reduction in Lead Emissions under Alternative NAAQS at each Monitor Area with Identified and Unidentified Controls.

Monitor State	Monitor County	Baseline Lead Emissions in 2020	Reduction in Lead Emissions (tpy) under Alternative NAAQS			
			Proposed NAAQS: 0.30 µg/m^3 2nd Maximum Monthly Mean	**Proposed NAAQS: 0.20 µg/m^3 2nd Maximum Monthly Mean**	**Proposed NAAQS: 0.10 µg/m^3 2nd Maximum Monthly Mean**	**Alternative Standard: 0.05 µg/m^3 2nd Maximum Monthly Mean**
AL	Pike	4.45	4.03	4.13	4.40	4.40
CA	Los Angeles	0.72	0.00	0.00	0.00	0.41*
CA	San Bernardino	0.12	0.00	0.00	0.00	0.04
CO	Adams	2.44	0.37	0.73	1.45	2.15*
CO	Denver	2.77	0.04	0.32	1.51	2.37*
CO	El Paso	0.95	0.00	0.00	0.56	0.78*
FL	Hillsborough	1.73	1.10	1.19	1.26	1.26
GA	DeKalb	0.03	0.00	0.00	0.00	0.00*
GA	Muscogee	0.47	0.00	0.00	0.00	0.42*
IL	Cook	0.90	0.00	0.00	0.00	0.71*
IL	Madison	0.53	0.00	0.00	0.13	0.39
IL	St. Clair	1.71	0.00	0.00	0.10	0.93
IN	Delaware	1.53	1.38*	1.38*	1.38*	1.38*
IN	Lake	7.26	0.00	0.00	0.00	1.51
IN	Marion	5.65	0.00	0.00	0.00	1.49
MN	Dakota	4.51	0.00	0.00	3.07	3.07
MO	Iron	27.84	12.20	13.53	21.74	25.84
MO	Jefferson	47.89	21.53	31.04	40.54	44.01*
MO	St. Louis	0.02	0.00	0.00	0.00	0.00
NJ	Middlesex	1.72	0.00	0.00	0.61	1.33
NY	Orange	1.80	0.00	1.40	1.40	1.70
OH	Cuyahoga	1.20	0.22	0.58	0.92*	0.92*
OH	Fulton	0.49	0.27	0.34	0.40	0.42*
OH	Logan	0.12	0.02	0.06	0.07*	0.07*
OK	Ottawa	0.00	0.00	0.00	0.00*	0.00*
PA	Allegheny	0.22	0.00	0.00	0.00	0.14
PA	Beaver	5.02	0.00	0.55	2.93	4.15
PA	Berks	2.18	1.62	1.78	1.97	1.97*
PA	Cambria	0.01	0.00	0.00	0.00	0.00*
PA	Carbon	0.46	0.00	0.16	0.27*	0.27*
TN	Sullivan	0.38	0.00	0.00	0.15	0.30
TN	Williamson	2.55	1.97	2.07	2.31	2.53
TX	Collin	3.18	2.24	2.70	2.95	3.14
TX	Dallas	0.03	0.00	0.00	0.00	0.00*
TX	El Paso	0.18	0.00	0.00	0.00	0.05
UT	Salt Lake	4.41	0.00	0.00	0.74	3.56
Total**		132.5	46.96	61.91	90.73	111.57

* Indicates monitor area does not reach attainment using identified and unidentified controls.
** Total values do not equal the sum of emissions and reductions values for each monitor area, as some sources are within 10 kilometers of two monitors, and therefore their emissions are counted once in each monitor area.

Table 4-8. Ambient Lead Concentrations Achieved with Identified and Unidentified Controls Under Alternative NAAQS in 2020.

Monitor State	Monitor County	Ambient Lead Concentration (µg/m^3) attained under Alternative NAAQS				
		Baseline Maximum Monthly Mean	0.30 µg/m^3 Second Maximum Monthly Mean	0.20 µg/m^3 Second Maximum Monthly Mean	0.10 µg/m^3 Second Maximum Monthly Mean	0.05 µg/m^3 Second Maximum Monthly Mean
AL	Pike	2.420	0.250	0.196	0.051	0.050
CA	Los Angeles	0.076	0.076	0.076	0.076	0.072*
CA	San Bernardino	0.068	0.068	0.068	0.068	0.050
CO	Adams	0.440	0.300	0.200	0.100	0.065*
CO	Denver	0.229	0.226	0.200	0.100	0.053*
CO	El Paso	0.131	0.131	0.131	0.100	0.091*
FL	Hillsborough	1.380	0.214	0.123	0.048	0.048
GA	DeKalb	0.100	0.100	0.100	0.100	0.100*
GA	Muscogee	0.100	0.100	0.100	0.100	0.056*
IL	Cook	0.097	0.097	0.097	0.097	0.061*
IL	Madison	0.128	0.128	0.128	0.100	0.050
IL	St. Clair	0.093	0.093	0.093	0.093	0.050
IN	Delaware	5.022	0.352*	0.352*	0.352*	0.352*
IN	Lake	0.053	0.053	0.053	0.053	0.049
IN	Marion	0.079	0.079	0.079	0.079	0.038
MN	Dakota	0.192	0.192	0.192	0.039	0.039
MO	Iron	1.454	0.232	0.200	0.100	0.050
MO	Jefferson	0.527	0.300	0.200	0.100	0.064*
MO	St. Louis	0.036	0.036	0.036	0.036	0.036
NJ	Middlesex	0.143	0.143	0.143	0.100	0.050
NY	Orange	0.240	0.240	0.084	0.084	0.050
OH	Cuyahoga	0.377	0.279	0.200	0.143*	0.143*
OH	Fulton	0.530	0.300	0.200	0.100	0.075*
OH	Logan	0.360	0.300	0.200	0.159*	0.159*
OK	Ottawa	0.114	0.114	0.114	0.114*	0.114*
PA	Allegheny	0.064	0.064	0.064	0.064	0.047
PA	Beaver	0.224	0.224	0.200	0.100	0.050
PA	Berks	0.517	0.300	0.200	0.103*	0.103*
PA	Cambria	0.056	0.056	0.056	0.056	0.056*
PA	Carbon	0.294	0.294	0.200	0.140*	0.140*
TN	Sullivan	0.154	0.154	0.154	0.100	0.050
TN	Williamson	0.820	0.206	0.174	0.100	0.031
TX	Collin	0.891	0.288	0.164	0.096	0.045
TX	Dallas	0.084	0.084	0.084	0.084	0.084*
TX	El Paso	0.054	0.054	0.054	0.054	0.050
UT	Salt Lake	0.107	0.107	0.107	0.093	0.040

Table 4-9. Number of Monitor Sites Reaching Attainment with Each Alternative Standard using Identified and Unidentified Controls

Standard	Number of Sites Analyzed	Number of Sites in Attainment with No Additional Controls	Number of Sites in Attainment with Identified Point Source Controls	Number of Sites in Attainment with Unidentified and Identified Point Source Controls
0.30 μg/m3 Second Maximum Monthly Mean	36	24	30	35
0.20 μg/m3 Second Maximum Monthly Mean		20	26	35
0.10 μg/m3 Second Maximum Monthly Mean		13	20	30
0.05 μg/m3 Second Maximum Monthly Mean		1	10	19

4.5. Key Limitations

The estimates of emission reductions associated with the control strategies described above are subject to important limitations and uncertainties. We summarize these limitations as follows:

- ***Analysis Only Considers Controls on Point Source Emission Reductions.*** Because the available data are not sufficiently detailed to assess the impact of indirect fugitive or area nonpoint source controls, the analysis of air quality impacts does not account for the potential implementation of such controls in areas where they might be effective. Although the analysis estimates the impact of point source controls on indirect fugitives, it does not consider the impact of controlling these emissions directly. This and the lack of control information for area nonpoint sources may have contributed to our projection of nonattainment in some areas.

- ***Actual State Implementation Plans May Differ from our Simulation***: In order to reach attainment with the proposed NAAQS, each state will develop its own implementation plan implementing a combination of emissions controls that may differ from those simulated in this analysis. This analysis therefore represents an approximation of the emissions reductions that would be required to reach attainment and should not be treated as a precise estimate.

- ***Limited Emissions Controls Considered***: Because limited data are available on fugitive and area source emissions and the extent to which these emissions contribute to ambient lead concentrations, our analysis does not consider fugitive and area source controls that may be implemented to comply with the revised NAAQS. Additionally, for this analysis we have not modeled the effect of any potential changes in emissions at airports with lead emissions associated with use of leaded aviation gasoline. As discussed above, we were not able to obtain emissions control information for a large number of point sources in our analysis. Although these sources collectively accounted for less than one fourth of all lead emissions considered, many of those sources were located in areas that were not able to reach attainment with one or more of the standards using identified controls alone. If more emissions control information were available, it may not be necessary to rely on estimated emissions reductions from unidentified point sources in order to simulate attainment with the alternative NAAQS.

- ***Emissions Reduction from Unidentified Controls***: In this chapter we report emissions reductions from both identified and unidentified emissions controls. We have taken care to report these separately, in recognition of the greater uncertainty associated with achieving emissions reductions from measures that may not be currently in use or known to EPA. Nonetheless, EPA believes it is reasonable to project that, with at least 10 years of lead time before a 2020 compliance deadline, a large number of existing measures will be adapted to be applicable to additional sources, and new measures may be developed that are specifically focused on cost-effectively reducing PM emissions with high lead content. Because the current standard is attained in all but a few areas of the country, and has been for many years since the phase down of lead in gasoline, it is likely that very little effort has been devoted to development of lead emissions control technologies except for industries where regulations have been imposed to reduce lead (e.g., large MWC standard, primary and secondary lead smelter MACTs, etc.). As a result, EPA believes that application of unidentified controls is particularly appropriate for compliance with a more stringent lead NAAQS.

- ***Using the Entire Marginal Cost Curve***: The marginal cost curve for this analysis was derived from the costs to the larger sources for which we had identified controls. To estimate the costs of unidentified controls, we chose a constant cost equal to the 98th percentile of the marginal cost curve. We recognize that valuing all unidentified tons at the same cost per ton is an oversimplification. We also recognize that as we add additional levels of control to well-controlled sources to capture an ever smaller increment of emissions, the marginal cost of the additional emission control generally increases. In these instances, taking into account the entire marginal cost curve may more fully capture the increasing cost. Note also that in this analysis, unidentified controls include not only additional levels of control for well-controlled sources, but also sources that were not matched with known controls. We do not know whether this second level of uncertainty will lead to higher costs per ton. For the final RIA we intend to explore both finding more identified controls, and also finding ways to value unidentified controls that do not use a single constant cost per ton.